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Introduction to the thematic issue "From brain function to therapy"

BARTLETT Perry F[1*] & HE RongQiao[2*]

[1]*Queensland Brain Institute, The University of Queensland, Brisbane, Queensland 4072, Australia;*
[2]*Institute of Biophysics, Chinese Academy of Sciences, Beijing 100101, China*

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This thematic issue of *Science China Life Sciences*, "From brain function to therapy", highlights some of the exciting research being undertaken in the Joint Laboratory of Neuroscience and Cognition, an international scientific collaboration between the Queensland Brain Institute (QBI) at The University of Queensland and the Institute of Biophysics (IBP) within the Chinese Academy of Sciences.

The Joint Laboratory was formally opened in Brisbane, Australia on 26 September 2010 and in Beijing, China on 4 November 2010, however, the seeds for this collaboration had been planted two years earlier. At this first meeting in 2008, we realised the great potential in a collaborative program given the complementary expertise and technologies of our two institutes and their joint focus on the discovery of cellular and molecular mechanisms regulating brain circuitry and function. Moreover, we were both firmly committed to exploiting this knowledge to develop new therapies to treat the rising number of people with neurological and mental illnesses. Together, these brain diseases account for close to 40% of the total burden of diseases endured by our two communities. This dual objective of course is captured in the title of this issue: "From brain function to therapy".

This issue begins with a number of in-depth reviews exploring the molecular regulation of important developmental processes, which may affect functional outcomes and underlying disease processes. The collaboration between Professor Liu Yaobo (IBP) and Associate Professor Helen Cooper (QBI) is focussed on understanding the molecular guidance cues in the embryo, in the hopes that the knowledge gained will support the development of innovative therapeutic strategies to regulate axon tract formation in the diseased or damaged brain. Their first review [1] explores the role of molecular navigation cues, Wnt5a/Ryk, in mediating the guidance of axons to form the major structures in the mammalian central nervous system, the corpus callosum and the corticospinal tract. The second piece, by Chen and colleagues, reviews the role of the molecular motor dynein in a number of neurological diseases [2].

Professor Sun JianYuan (IBP) and Professor Frederic Meunier's (QBI) collaboration seeks to better understand how neurons chemically "talk" to one another. In this issue they describe what is currently known of the molecular mechanisms underpinning the process of bulk endocytosis in a number of neuronal models [3]. Professor Sun collaborates also with Professor Pankaj Sah (QBI) on the physiology of information processing in the amygdala, the key site for emotional processing in the brain. In this issue, they review research on the amygdala and the processing of pain [4]. By better understanding the pathways involved, more specific therapeutics can be developed for the treatment of conditions such as chronic pain.

*Corresponding author (email: p.bartlett@uq.edu.au; rongqiaohe@163.com)

Professor Liu Li (IBP) and Associate Professor Bruno van Swinderen (QBI) jointly develop sophisticated brain recording technologies to study behavioural circuitry in *Drosophila*. They describe here their insights into how sensory input regulates feeding behaviour in *Drosophila* [5].

The overarching aim of the collaboration between the He (IBP) and Bartlett (QBI) laboratories is to identify molecular mechanisms of learning and memory. In our review, we discuss the role of the *N*-methyl-D-aspartate receptor (NMDAR) in regulating the pools of neural stem and precursor cells in the hippocampus, which play such a crucial part in regulating the neurogenesis that underpins hippocampal learning and memory. Enhancement of this neurogenic process may be potentially used to ameliorate the effects of dementia [6]. In collaboration with Professor Jürgen Götz's laboratory (QBI), the He laboratory further explores processes underlying the major form of dementia, Alzheimer's disease (AD). Chen and colleagues provide new evidence for how the Chinese herbal medicine Tong Luo Jiu Nao and its main constituent, Geniposide, may be effective in the treatment of AD [7]. In a second study, the He and Götz laboratories explore the cellular distribution of tau, a protein that appears to trigger the pathological effects in AD, and show that tau exists in the cell nucleus, in a less-phosphorylated form, providing new evidence for alternate pathways of tau-mediated toxicity [8].

Also focussed on neurodegenerative diseases such as motor neuron disease, Professor Wu Jane (IBP) and Dr Marie Mangelsdorf (QBI) provide insights into the role played by aberrant expression and mutation of genes coding for RNA-binding proteins in initiating human brain disease [9].

This thematic issue also features some more unusual and interesting studies being undertaken by members of the Joint Laboratory that go from exploring the earliest history of our understanding of the brain and its function—Professors He RongDing (Chengdu University) and He RongQiao (IBP) provide evidence for the Sanxingdui bronze relics being the earliest objects to demonstrate accurate anatomical representation of the human eye [10]—through to investigating how conditions experienced by astronauts in outer space may affect brain function—the He and Bartlett laboratories present evidence to suggest that the negative effect of the hypomagnetic field may, in part, be due to the MAPK pathway and cryptochrome [11].

Looking toward the next great frontier in neuroscience—understanding the detailed circuitry and connections that underpin brain functions and dysfunctions—Professor Jiang TianZi, who holds an appointment at both QBI and the Institute of Automation (IA) within the Chinese Academy of Sciences (CASIA), provides his insights into the development and challenges faced by an international consortium attempting to achieve this outcome, and describes how the Sino-Australian Joint Laboratory of Brainnetome recently established between QBI and CASIA will undertake multi-level, multi-modal imaging approaches to address this problem [12]. In this edition, articles have been ordered to reflect the groups that collaborate within the Joint Laboratory.

We are extremely grateful for all the support the Joint Laboratory has received from the Chinese Academy of Sciences, especially Professor Cao JingHua, who was instrumental in bringing the institutes together, The University of Queensland, and the Queensland State Government, who has established a unique and prescient joint funding arrangement with the Chinese Academy of Sciences. We would like also to acknowledge Miss Ashley Cooper, without whose exceptional skills in editing and co-ordination this issue would not have been possible.

1 Clark CEJ, Liu YB, Cooper HM. The Yin and Yang of Wnt/Ryk axon guidance in development and regeneration. Sci China Life Sci, 2014, 57: 366–371
2 Chen XJ, Xu H, Cooper HM, Liu YB. Cytoplasmic dynein: a key player in neurodegenerative and neurodevelopmental diseases. Sci China Life Sci, 2014, 57: 372–377
3 Nguyen TH, Qiu XF, Sun JY, Meunier FA. Bulk endocytosis at neuronal synapses. Sci China Life Sci, 2014, 57: 378–383
4 Strobel C, Hunt S, Sullivan R, Sun JY, Sah P. Emotional regulation of pain: The role of noradrenaline in the amygdala. Sci China Life Sci, 2014, 57: 384–390
5 Sun F, Wang YJ, Zhou YQ, van Swinderen B, Gong ZF, Liu L. Identification of neurons responsible for feeding behavior in the *Drosophila* brain. Sci China Life Sci, 2014, 57: 391–402
6 Taylor CJ, He RQ, Bartlett PF. The role of the N-methyl-D-aspartate receptor in the proliferation of adult hippocampal neural stem and precursor cells. Sci China Life Sci, 2014, 57: 403–411
7 Chen JY, Sun MR, Wang XH, Lu J, Wei Y, Tan Y, Liu Y, Götz J, He RQ, Hua Q. The herbal compound Geniposide rescues formaldehyde-induced apoptosis in N2a neuroblastoma cells. Sci China Life Sci, 2014, 57: 412–421
8 Lu J, Li T, He RQ, Bartlett PF, Götz J. Visualizing the microtubule-associated protein tau in the nucleus. Sci China Life Sci, 2014, 57: 422–431
9 Zhou HL, Mangelsdorf M, Liu JH, Zhu L, Wu JY. RNA-binding proteins in neurological diseases. Sci China Life Sci, 2014, 57: 432–444
10 He RD, He RQ. What did the bronze eye-like prism tell us?. Sci China Life Sci, 2014, 57: 445–447
11 Mo WC, Liu Y, Bartlett PF, He RQ. Transcriptome profile of human neuroblastoma cells in the hypomagnetic field. Sci China Life Sci, 2014, 57: 448–461
12 Jiang TZ. Brainnetome and related projects. Sci China Life Sci, 2014, 57: 462–466

Biographical Sketch

Professor Perry Bartlett has been responsible for a series of ground-breaking discoveries in neuroscience, which have often overturned existing dogma and led to a new understanding, particularly in the areas of neuronal precursor regulation and neuron survival in the developing and adult nervous system. Most prominent amongst these, was his laboratory's discovery in 1992 of the presence of stem cells in the adult brain that had the capacity to produce new neurons. His group was first to isolate and characterise these stem cells in 2001 and more recently revealed the presence of a latent hippocampal stem cell population that influences learning and memory.

Professor Bartlett is the inaugural Director of the Queensland Brain Institute and holds the Foundation Chair in Molecular Neuroscience at The University of Queensland. He is a Fellow of the Australian Academy of Science (FAA), a past National Health and Medical Research Council Senior Principal Research Fellow and Australian Research Council Federation Fellow, and a past President of the Australian Neuroscience Society. He has championed interactions with China, establishing three joint neuroscience laboratories, two with the Chinese Academy of Sciences and one with the Second Military Medical University. With Professor He, Professor Bartlett leads the Joint Laboratory of Neuroscience and Cognition.

Biographical Sketch

Professor He RongQiao's work is focussed on understanding the effects of aldehydes, such as formaldehyde, on the structure and function of neural proteins in Alzheimer's and Parkinson's disease. At present, the focus of his laboratory is on chemical modification and aggregation of protein, and the risk factors that trigger hyperphosphorylation of neuronal tau—and the association of these with age-related cognitive impairment. Professor He has hypothesised that advanced age is associated with an imbalance in the metabolism of endogenous formaldehyde, and that this imbalance is a risk factor for neurodegeneration. He has demonstrated that D-ribose, which induces cognitive impairment when present at an abnormally high level, is positively correlated with the level of glycated haemoglobin found in type 2 diabetics.

Professor He is the Deputy Director of the Institute of Biophysics at the Chinese Academy of Sciences. He is former Director of the Centre for Brain and Cognitive Science and former Executive Director of the State Key Laboratory of Brain and Cognitive Science. With Professor Perry Bartlett, Professor He leads the Joint Laboratory of Neuroscience and Cognition.